SUMMER TRAVEL ON THE TUNDRA WITH LOW GROUND PRESSURE VEHICLES

Test Report: June 4, 1970 Field Studies
Institute of Arctic Environmental Engineering
University of Alaska

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Glenn R. Burt - July 1, 1970

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SUMMER TRAVEL ON THE TUNDRA WITH LOW GROUND PRESSURE VEHICLES

Glenn R. Burt

Report of a Test Sponsored By

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Burt, G.R., Summer travel on the tundra with low ground pressure vehicles, Inst. Arctic Environ. Eng., Univ. Alaska, Note 7004, 9 p, 1970.

INTRODUCTION

Increased activity on the North Slope of Alaska has brought on numerous problems for industry and government regarding surface transportation across the tundra. Winter travel is generally unrestricted, but during spring, summer and fall when conditions are most favorable for many operations movement over thawed ground in all types of vehicles is prohibited by government regulations. These regulations limiting other than winter travel to existing roadways are the results of rising concern over damage to the environment. In the past some operations have left marks on the terrain and, according to many people, created problems. These problems may be divided into several categories:

1. **Marks On The Tundra.** Travel over thawed or frozen tundra can create visible marks. Some opinions claim any mark is detrimental, and any operation leaving a mark should not be allowed.
2. **Erosion Of The Land.** In areas of relief or sloping topography extensive erosion can occur when destruction of the tundra mat concentrates water movement.
3. **Formation Of Lakes and Ponds.** Where the terrain is relatively level, thaw of high water content permafrost following tundra destruction can create new ponds or lakes.

Although some research has been and is being done by industry on disturbance and restoration, and several projects are under way studying various vegetative types in the Arctic, little information is available satisfactorily documenting cause and effect of disturbance or damage to the tundra. The only published material to date deals with effect, showing deep ruts and resulting erosion, with no evaluation of vehicles, number of vehicle passes over the same area, topography or types of vegetation involved.

This report concerns one phase of a test of low ground pressure vehicles moving over thawed tundra.

1969—SUMMER STABILIZATION TESTS USING LOW GROUND PRESSURE TRACKED VEHICLES

In the summer of 1969 Mobil Oil Corporation, Flextrac Nodwell Ltd., the Department of Natural Resources, and other State agencies participated in a "Summer Tundra Stability Test Using Low Ground Pressure Tracked Vehicles." A report bearing the above title was written by J. H. Piggott of Flextrac Nodwell and W. R. Belcher of Mobil Oil Corporation. A second report was prepared by William Sacheck of the Division of Forestry and Blaine Halliday of the U.S. Department of Agriculture for submittal to the Commissioner of Natural Resources. Both indicate all observers were impressed that operation of vehicles on the tundra need not cause significant damage.

Tested equipment were a Nodwell FN-400, used to carry heavy loads, and a Nodwell FN-110, used extensively in seismographic work. Most tundra marking, as stated in the reports, was the result of the detent in the center of each track, however, the majority of observers did not feel the indentations would cause meaningful damage. The Nodwell-Mobil report concluded that removal of the FN-110's detent would

LOADED NODWELL FN-400 WITH 'FLAT' TRACK

allow many passes over the same area without creating permanent injury, and similar revision of the FN-400 would likely eliminate most tundra disturbance caused by this machine. It was recommended that a new 'flat' track be designed and built for testing at the same site. Nodwell developed one for the FN-400, and efforts were made to test it in late August 1969, but various problems hindered satisfactory trials. Reports state, however, that all present were sure the track would permit summer movement on the tundra without significant damage, especially in dry areas. Plans were made for further testing during the summer of 1970.

SUMMER TRAFFIC ON THE TUNDRA

SITE LOCATION AND CONDITIONS

The 1970 test site is parallel to the 1969 site, located in Section 11, Township 11N, Range 11E, Umiat Meridian near the West Kuparuk drill site about 8 miles west of the Kuparuk River. Terrain and vegetative conditions were similar to those described in the aforementioned reports. One major difference was the depth of thaw. On 4 June 1970 the average depth of thaw into the tundra mat was 1 to 2 inches, with minor patches of snow 1 to 5 inches deep, and small puddles or ponds of spring melt water.

EQUIPMENT TESTED

1. A Flextrac Nodwell FN-400 using the newly designed 'flat' track. The 58,000 pound unit carried a 48,000 pound payload, making the total weight approximately 106,000 pounds. Loaded, the ground bearing pressure is approximately 3 1/2 pounds per square inch, as stated by the manufacturer.

2. A six wheel, 3 axle Rolligon with low ground pressure balloon tires.

FOUR WHEEL ROLLIGON

3. A four wheel, 2 axle Rolligon with low ground pressure balloon tires.

4. A four wheel, 2 axle Carey with low ground pressure balloon tires.

Weights on the Rolligons and the Carey are unknown to this writer, but may be obtained from the manufacturers in Houston, Texas.

TEST SECTIONS

Seven 1,000 foot test strips were established at the West Kuparuk Site as shown on the attached sketch. Four sections were used for testing the Nodwell FN-400 and three sections for the two Rolligons.

Section 1: The FN-400 fully loaded made three passes in the same tracks.

Section 2: The FN-400 fully loaded made one pass in this section.

Section 3: The FN-400 fully loaded made ten passes in the same tracks.

Section 4: The empty FN-400 made ten passes in the same tracks.

Section 5: The empty four wheel Rolligon made ten passes in the same tracks.

Section 6: The empty six wheel Rolligon made ten passes in the same tracks.

Section 7: The four wheel Rolligon carrying a 6,000 pound payload made ten passes in the same tracks.

Several sections were laid out near Dead Horse for testing the Carey to avoid moving it to the West Kuparuk Site. On 5 June 1970 a test similar to that of the four wheel Rolligon was performed.

SIX WHEEL ROLLIGON

OBSERVATIONS

Flextrac Nodwell FN-400 With 'Flat' Track

1. There was no noticeable significant difference in tundra disturbance between empty and loaded tests.

2. After one trip it was difficult, if not impossible, to find where the vehicle had been, especially in dry areas.

3. After three trips in the same track some marking was obvious, but there appeared to be little or no significant damage to the tundra.

4. After ten trips in the same track, marking and cutting of the tundra had occurred. A careful study of the area indicated the disturbance will not destroy the tundra; the mat will be able to restore itself.

Rolligon

1. There was no noticeable significant difference in tundra disturbance between empty and loaded tests.

2. After one trip it was difficult, if not impossible, to find where the vehicle had been, especially in dry areas.

3. After three trips in the same track some marking was obvious, but there appeared to be little or no significant damage to the tundra.

4. After ten trips in the same track, marking and cutting of the tundra had occurred. A careful study of the area indicated the disturbance will not destroy the tundra; the mat will be able to restore itself.

5. The Rolligon left a larger area of the tundra more compacted than the Nodwell, but cutting was not as pronounced.

(See attached photographs)

Carey

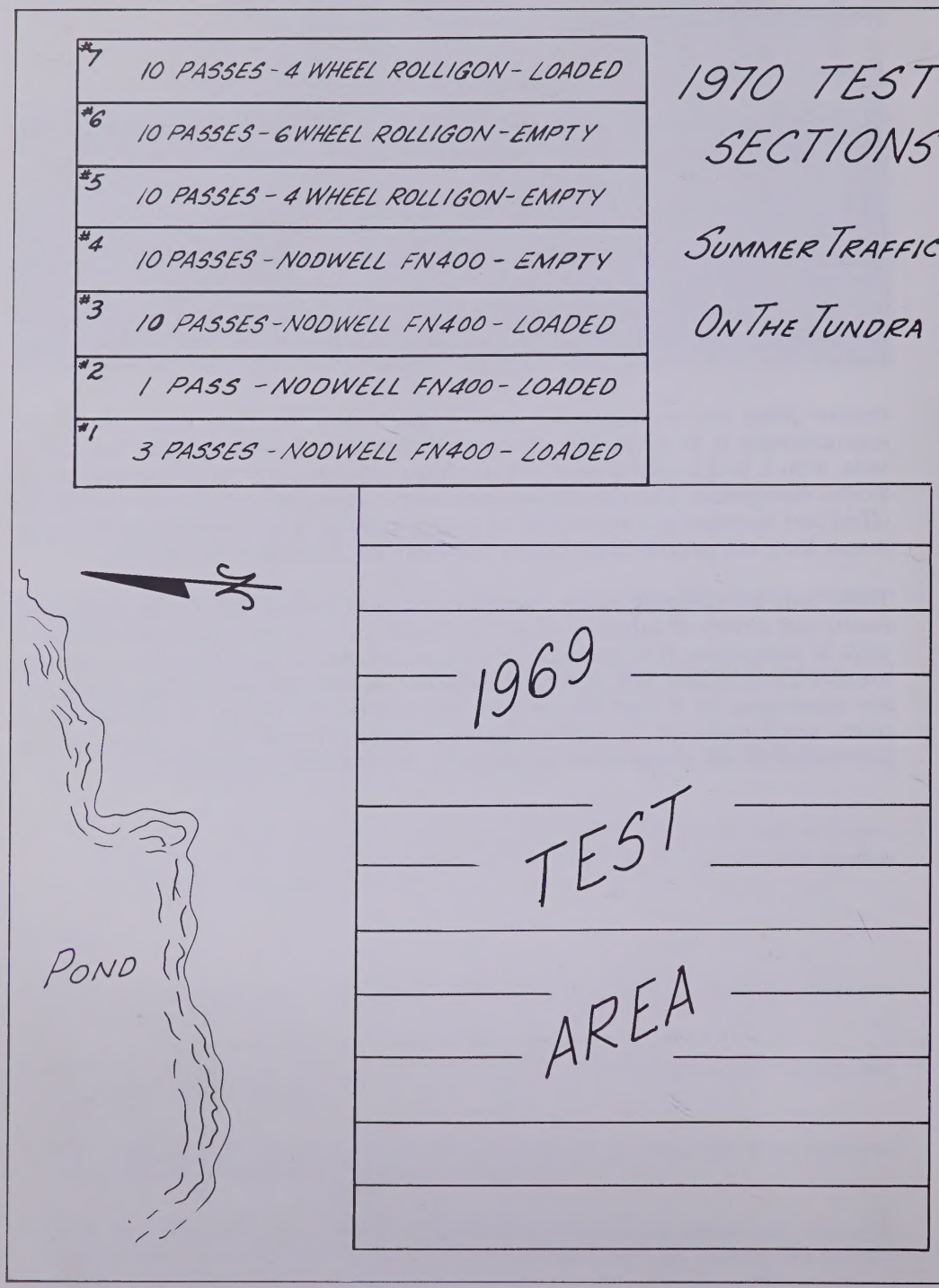
This machine performed comparable to the Rolligon, except the tire cleats were harder, with sharper edges inflicting more pronounced cuts in the tundra.

CONCLUSIONS AND RECOMMENDATIONS

After inspection of the 1969 test site observers felt the tundra disturbance was principally caused by the detent in the Nodwell tracks. The 1970 tests indicate this can be eliminated by the new 'flat' track. All observers at the June 1970 test were impressed by the performance of each vehicle regarding the minor disturbance created.

Present plans are to repeat the tests in July when the thaw depth should be approximately 6 to 12 inches. The general consensus, however, is that the June 4 tests, with 1 to 2 inches of thaw and standing melt water, will reveal the most severe tundra disturbance. The thin thawed mat over a frozen base allows little cushioning effect and increases the probability of tundra incision. It is commonly believed that deeper thaw will provide more tundra flexibility and permit less disturbance.

These tests are pertinent to the establishment of guidelines for summer travel, but results and effects of actual work on the tundra can only be ascertained after such work is completed. It is therefore recommended that a specific project requiring summer travel be used as a prototype evaluation or test. The project should be under the supervision of a qualified research organization for careful monitoring of all traffic and disturbance, to thereby establish criteria for regulations covering summer moverment on the tundra based on adequate, accurate field information.


#7 10 PASSES - 4 WHEEL ROLLIGON - LOADED
#6 10 PASSES - 6 WHEEL ROLLIGON - EMPTY
#5 10 PASSES - 4 WHEEL ROLLIGON - EMPTY
#4 10 PASSES - NODWELL FN400 - EMPTY
#3 10 PASSES - NODWELL FN400 - LOADED
#2 1 PASS - NODWELL FN400 - LOADED
#1 3 PASSES - NODWELL FN400 - LOADED
1970 TEST SECTIONS
SUMMER TRAFFIC ON THE TUNDRA
1969 TEST AREA
POND

TUNDRA AFTER ONE PASS OF NODWELL FN-400

TUNDRA AFTER THREE PASSES WITH NODWELL FN-400

TUNDRA AFTER TEN PASSES WITH NODWELL FN-400

TUNDRA AFTER ONE PASS WITH ROLLIGON

TUNDRA AFTER TEN PASSES WITH ROLLIGON

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